



Merced County ROP Automotive Services Summer Program

This course is based on 6 hours/day – 3 days/week for 5 weeks totaling 90 hours. Students will have classroom instruction by a Career Technical Education teacher and a Physics teacher plus applied learning in the Automotive Training Center.

| Unit of Instruction | Physics Objectives, CTE Standards and Key Vocabulary |
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| <p align="center">Week 1: Introduction to Automotive Technician</p> <p>The Auto Shop and Safety</p> <ol style="list-style-type: none"> Describe the typical layout and sections of an auto shop. List the types of accidents that can occur in an auto shop. Explain how to prevent auto shop accidents. Describe general safety rules for the auto shop. <p>Basic Hand Tools</p> <ol style="list-style-type: none"> Identify common automotive hand tools. Hand tool safety. Select the right tool for a given job. Maintain and store tools properly. <p>Power Tools and Equipment</p> <ol style="list-style-type: none"> List the most commonly used power tools and equipment. Describe the uses for power tools and equipment. Explain the advantages of one type of tool over another. Power tool and equipment safety. | <p>Physics Objectives:</p> <ul style="list-style-type: none"> Distinguish between linear and rotational force Establish connection between force and torque <p>CTE Standards for Transportation Industry:</p> <ul style="list-style-type: none"> C1.0, C1.1, C1.2, C1.5 C2.0, C2.1, 2.2, 2.3 <p>Key Vocabulary:</p> <ul style="list-style-type: none"> Force Linear Force Rotational force Torque Angular displacement |
| <p align="center">Week 2: Introduction to Automotive Technician</p> <p>Vehicle Maintenance, Fluid Service, and Recycling</p> <ol style="list-style-type: none"> Inspect fluid levels. Explain the importance of vehicle maintenance. Locate fluid leaks. Replace engine oil and filter. Change automatic transmission fluid and filter. Lubrication as required by manufacturer. Conduct inspection of hoses, belts, and other related components, replace as needed. Demonstrate safe practices while handling and disposing of vehicle fluids/lubricants. Perform engine oil pressure tests; determine needed repairs. Perform cooling system tests (pressure, combustion leakage, and temperature); determine needed repairs. | <p>Physics Objectives:</p> <ul style="list-style-type: none"> Change the cooling/heating properties of a fluid <p>CTE Standards for Transportation Industry:</p> <ul style="list-style-type: none"> C4.0, C4.1, C4.2, C4.3, C4.4 <p>Key Vocabulary:</p> <ul style="list-style-type: none"> Fluid Liquid Viscosity Lubrication Oil pressure Cooling system |

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| <p style="text-align: center;">Week 3: Fundamentals of Engines</p> <p>Engine Fundamentals</p> <ol style="list-style-type: none"> 1. Automotive engine nomenclature. 2. Describe the four-stroke cycle. 3. Define common engine terms. 4. Explain the basic function of the major parts of an internal combustion engine. 5. Cite and demonstrate safe working practices related to engines. <p>Engine Design Classifications</p> <ol style="list-style-type: none"> 1. Describe basic automotive engine classifications. 2. Describe differences of gasoline and diesel engines. 3. Contrast combustion chamber design. 4. Discuss alternative fuel/hybrid 5. Describe the differences between two/four-stroke cycle engines. <p>Engine size and Performance Measurements</p> <ol style="list-style-type: none"> 1. Describe engine size measurements based on bore, stroke, displacement, and number of cylinders. 2. Explain engine compression ration and how it affects engine performance. 3. Explain engine torque and horsepower ratings. 4. Demonstrate the different methods used to measure and rate engine performance. 5. Explain volumetric efficiency, thermal efficiency, mechanical efficiency, and total engine efficiency. 6. Follow safe practices when making engine performance measurements. | <p>Physics Objectives:</p> <ul style="list-style-type: none"> • Identify work done by an engine • Determine horsepower ratings • Relate pressure and surface area/volume <p>CTE Standards for Transportation Industry:</p> <ul style="list-style-type: none"> • C1.0, C1.3, C1.5 • C2.0, C2.1, C2.2 • C3.0, C3.1, C3.3, C3.4, C3.5, C3.6, C3.7 <p>Key Vocabulary:</p> <ul style="list-style-type: none"> • Work (as it relates to physics) • Horsepower • Pressure • Volumetric efficiency • Thermal efficiency • Mechanical efficiency • Total engine efficiency • 2-strok engine • 4-stroke engine • Hybrid • Combustion |
| <p style="text-align: center;">Week 4: Suspension, Steering, and Brakes</p> <p>Brake System Fundamentals</p> <ol style="list-style-type: none"> 1. Explain the hydraulic and mechanical principles of a brake system. 2. Identify the major parts of an automotive brake system. 3. Define the basic functions of the major parts of a brake system. 4. Compare drum and disc brakes. 5. Describe the operation of parking brakes. 6. Explain the operation of power brakes. <p>Brake System Diagnosis & Repair</p> <ol style="list-style-type: none"> 1. Diagnose common brake system problems. 2. Diagnose poor stopping, noise, pulling, grabbing, dragging, or pedal pulsation caused problems; determine needed repairs. 3. Inspect and maintain a brake system. | <p>Physics Objectives:</p> <ul style="list-style-type: none"> • State Newton’s 1st Law of Motion • Identify two basic states of motion • Correlate fluid pressure and volume <p>CTE Standards for Transportation Industry:</p> <ul style="list-style-type: none"> • C1.0, C1.1, C1.5 • C2.0, C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C2.7 • C8.0, C8.1, C8.2, C8.3, C8.6 |

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| <ol style="list-style-type: none"> 4. Describe basic procedures for servicing a master cylinder and a brake booster. 5. Explain how to service a disc brake assembly. 6. Explain how to service a drum brake assembly. 7. Describe the procedures for both manual and pressure bleeding of a brake system. <p>Anti-Lock Brakes, Traction Control, and Stability Control</p> <ol style="list-style-type: none"> 1. Inspect, test, and service anti-lock brake system (ABS) hydraulic, electrical, and mechanical components. 2. Identify the major parts of a typical anti-lock brake system. 3. Describe the operation of anti-lock brake systems. 4. Compare anti-lock brake systems. 5. Diagnose problems in anti-lock brake systems. 6. Repair anti-lock brake systems. 7. Describe the purpose and operation of traction control systems. 8. Diagnose and repair traction control and stability control systems. | <p>Key Vocabulary:</p> <ul style="list-style-type: none"> • Fluid pressure • Newton’s 1st Law of Motion • Hydraulic • Drum • Cylinder • Brake booster • Pressure differential value • Proportioning value • Metering value |
| <p style="text-align: center;">Week 5: Suspension, Steering, and Brakes</p> <p>Tire, Wheel, and Wheel Bearing Fundamentals</p> <ol style="list-style-type: none"> 1. Identify the parts of a tire and wheel. 2. Describe different methods of tire construction. 3. Explain tire and wheel sizes. 4. Describe tire ratings. 5. Identify the parts of driving and non-driving hub and wheel bearing assemblies. <p>Tire, Wheels, and Wheel Bearing Service</p> <ol style="list-style-type: none"> 1. Diagnose common tire, wheel, and wheel bearing problems. 2. Describe the inflation and rotation procedures. 3. Measure tire and wheel run-out. 4. Explain static and dynamic methods of balancing wheels and tires. 5. Summarize different methods of balancing wheels/tires. 6. Explain service procedures for wheel bearings. 7. Mounting and Dismounting Tires 8. Tire Puncture Repair 9. Wheel Bearing Service <p>Suspension System Fundamentals</p> <ol style="list-style-type: none"> 1. Identify the major parts of a suspension system. 2. Describe the basic function of each suspension system components. 3. Explain the operation of the four common types of springs. 4. Compare the various types of suspension systems. 5. Explain automatic suspension leveling systems. | <p>Physics Objectives:</p> <ul style="list-style-type: none"> • Identify the connection between circular motion and forces • Describe rotational velocity as related to position on an object in circular motion <p>CTE Standards for Transportation Industry:</p> <ul style="list-style-type: none"> • C1.0, C1.1, C1.5 • C2.0, C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C2.7 • C8.0, C8.1, C8.2, C8.3, C8.5, C8.6 <p>Key Vocabulary:</p> <ul style="list-style-type: none"> • Friction • Circular motion • Balanced forces • Brake shoes • Brake pad • Master cylinder • Run-out • Brake rotor • Brake disc |

